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Remarks

Thorough examination by the Examiner is noted and appreciated.

Applicants respectfully request Examiner to **withdraw the finality** of the previous office action since the new grounds of rejection were not necessitated by Applicants amendments in the previous office action.

See MPEP 706.07(a)

"Under present practice, second or any subsequent actions on the merits shall be final, except where the examiner introduces a new ground of rejection that is neither necessitated by applicant's amendment of the claims ..."

Applicants previous amendment did not necessitate the new grounds of rejection citing prior art not of record, Manos (US Pat. 5,672,212), since Applicants limitations now addressed by Manos were included in the original claims.

The claims have been amended to distinguish Applicants claimed invention over the prior art or place the claims in better form for appeal.

Support for the amended claims is found in the original claims and/or Specification. No new matter has been entered.

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Claim Rejections under 35 USC 103(a)

1. Claims 1, 5, 6, 10-12, and 21 stand rejected under 35 USC 103(a) as being unpatentable over Torii (2002/0068451) and Miller et al. (US Pat No. 6,464,568).

Torii describes a method for removing tungsten oxide over tungsten prior to a tungsten polishing process (see abstract). Torii disclose a multi-step polishing process for first removing the tungsten oxide and then polishing the tungsten (paragraphs 0027 and 0028). In one embodiment Torii discloses using a wet etching method by "immersing" the process surface in an "alkali aqueous solution" of sodium hydroxide or potassium hydroxide (paragraph 0033). Torii does not disclose a pH for the alkali aqueous solution.

Torii also discloses a sputter etch method using argon to remove the tungsten oxide layer prior to polishing (paragraph 0034). Torii does not disclose a dry etching method using fluorocarbons. Torii does not disclose a cleaning process prior to the CMP process following removal of the tungsten oxide.

Miller et al. disclose a CMP process for copper. Miller specifically discloses a pre-polish cleaning operation with a complexing acid buffer system on a CMP tool to remove copper

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oxide (see e.g., Abstract and col 5, lines 35-52, lines 59-60)).

The cleaning process is preformed on a CMP tool process without oxidizers and abrasives (col 5, lines 59 - 62). Miller et al. teach that the pH of the cleaning solution including an **organic acid chelating agent** may be ramped up over time to the pH of the polishing slurry used in a subsequent CMP process (col 5, lines 62-66). Miller et al. teach that KOH may be added as a buffer to the organic acid to create a buffer system (col 6, lines 32-33). Miller discloses a pH of the pre-polish cleaning solution to be in the range of about 2.5 to 4 (see e.g., col 6, lines 35-38) but does not disclose a pH of the polishing slurry. Miller et al. teach in one embodiment, a rinse step, performed on the same CMP tool, between the CMP tool cleaning step and the abrasive CMP step if the pH of the cleaning solution is higher than the pH of the polish slurry to avoid slurry gelation (col 7, lines 1-6). Miller et al. also disclose a post-CMP "scrubberless" cleaning operation on the CMP polishing tool (col 6, lines 15-19).

There are no teachings in Miller et al. that help Examiner in producing a *prima facie* case of obviousness except the fact that Miller et al. discloses a cleaning process following the pre-clean process under certain circumstances of pH.

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Moreover, there is no apparent reason for combining the teachings of Miller et al and Torii et al. since they are directed at different inventions and methods for removing different types of oxides (tungsten versus copper) using different solutions (e.g., organic acid versus NaOH or KOH) prior to a CMP polishing process. There is no reason to expect the method for removing copper oxide disclosed by Miller et al. would be successful in the process of Torii for removing tungsten oxide. Examiner asserts that Torii "teaches the metal film to be polish can be W, Al, Cu, or the like", but provides no support of this assertion which Applicants do not agree with. Torii only discusses these alternative metals in the background of the invention (col 1, paragraph 0006) to present the problem solved.

However, even assuming *arguendo* proper motive for combination, such combination does not produce Applicants claimed invention including a wet etching process including one of brushing and scrubbing. Rather, Torii only discloses an "immersion" oxide removal process and Miller et al. specifically teach away from such a process by teaching using a CMP tool in the oxide removal process in a "scrubberless" operation.

Neither Miller et al. nor Torri teach or disclose Applicants claimed invention including limitations in Applicants claim 1:

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"removing the layer of tungsten oxide according to an etching process selected from the group consisting of dry etching with a fluorocarbon etching chemistry and wet etching with a aqueous basic solution comprising agitating the wafer process surface by a method selected from the group consisting of applying megasonic energy and brushing;

cleaning the semiconductor wafer to include the wafer process surface according to a wet cleaning process; and,

chemically mechanically polishing the wafer process surface according to a CMP process comprising applying at least an abrasive slurry to the wafer process surface."

"First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

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"A prior art reference must be considered in its entirety, i.e., as a whole including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc., Garlock, Inc., 721 F.2d, 1540, 220 USPQ 303 (Fed Cir. 1983), cert denied, 469 U.S. 851 (1984).*

With respect to claim 5, Examiner asserts that Miller describes a variation in the pH, therefore "this would suggest that the pH is a result-effective variable". However, Miller et al. teaches and discloses an organic acid wet etching system which Applicants do not disclose and claim. Torii merely describes an "alkali" solution in an immersion process. Further, a result effective variable argument is only valid once the general conditions of Applicants invention has been shown in the prior art which the cited references (Torii and Miller et al.) do not accomplish.

With respect to claims 10 and 11, nowhere do Torii and Miller teach "wherein the CMP process further includes applying a polishing solution to the wafer process surface for forming an oxide layer in-situ over the tungsten". Rather, Torii discloses a two step CMP polishing process where the first CMP process is carried out with no oxidant and the second CMP process is carried out with an oxidant. Yet nowhere does Torii teach that an oxide layer is formed in-situ over the tungsten in the CMP polishing

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process which would clearly defeat the principal of operation in the first CMP process of Torii (see e.g., paragraph 0031).

"If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious." *In re Ratti*, 270 F.2d 810, 123, USPQ 349 (CCPA 1959).

With respect to claim 21, Examiner asserts that "claim 21 has no patentable weight since the claimed method for removing the oxide can be either wet or dry etching and Torii teaches wet etching". Examiner provides no support for this conclusory statement and is clearly mistaken concerning the Applicants disclosed and claimed invention and the requirements for making out a *prima facie* case of obviousness. In fact, as previously stated, Torii teaches in an alternative embodiment, a sputter etch method using argon to remove tungsten oxide layer prior to polishing (paragraph 0034). However, Torii does not disclose a dry etching method using fluorocarbons or fluorocarbons and oxygen as Applicants have disclosed and claimed.

2. Claims 3, 4, 9, 13, 15-19 stand rejected under 35 USC 103(a) as being unpatentable over Torii and Miller et al. as applied above, and further in view of Manos (US Pat. 5,672,212).

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Applicants reiterate the comments made above with respect to Torii and Miller et al.

Manos discloses a method and apparatus for cleaning or etching batches of wafers where the wafers are placed in a wafer carrier and are immersed in a megasonically agitated cleaning tank whereby the wafer carrier is simultaneously rotated while applying megasonic energy (see Abstract).

Manos does not disclose wet etching metal oxide prior to a CMP process or disclose a brushing process, or disclose acid or basic etchant solutions. Neither Torii nor Miller et al. suggest that a megasonic or brushing cleaning process would be beneficial or advantageous in their disclosed cleaning processes. Rather, the method of Torii teaches away from Applicants disclosed and claimed invention by specifically teaching an "immersion" or dipping wet etching process for tungsten oxide while Miller et al. specifically teaches away by teaching using a CMP tool for the wet etching process of copper oxide and a "scrubberless" cleaning process. Manos also does not disclose a cleaning process following an etching process. Moreover, it is not clear how one would adjust the pH or an etching solution in the apparatus of Manos using the method of Miller et al.



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There appears to be no specific motivation to combine the teachings of Manos et al with either Miller et al. or Torii, however, even assuming *arguendo* a proper motive for combining the teachings of the cited references, such combination does not produce applicants claimed invention. Among other factors, Examiner has not shown several elements of Applicants invention including a wet etching process at an appropriate pH, a dry etching process with a fluorocarbon etching chemistry to remove tungsten oxide, and a megasonic or brushing method to remove tungsten oxide using the claimed wet etchant. The motivation for combining the references appears to be impermissible hindsight reasoning using Applicants disclosure as a roadmap to re-create Applicants disclosed and claimed invention.

Applicants reiterate the comments made above with respect to claims 17, 18, and 19.

"The fact that references relied upon teach that all aspects of the claimed invention were individually known in the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references." *Ex parte Levengood*, 28 USPQ2d 1300 (Bd. Pat. App. & Inter. 1993).

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"Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure." *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)) Emphasis added.

Applicants further point out that "we do not pick and choose among the individual elements of assorted prior art references to recreate the claimed invention, but rather we look for some teaching or suggestion in the references to support their use in a particular claimed combination" *Symbol Technologies, Inc. v. Opticon, Inc.*, 935 F.2d 1569, 19 USPQ2d 1241 (Fed. Cir. 1991).

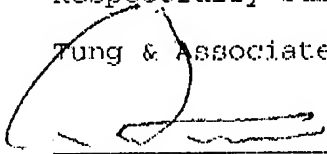
The Claims have been amended to distinguish Applicants claimed invention over the prior art and are now in condition for allowance or in better form for appeal. A favorable consideration of Applicants' claims is respectfully requested.

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In the event that the present invention as claimed is not in a condition for allowance for any other reasons, the Examiner is respectfully invited to call the Applicants' representative at his Bloomfield Hills, Michigan office at (248) 540-4040 such that necessary action may be taken to place the application in a condition for allowance.

Respectfully submitted,

Tung & Associates



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